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Heart Failure and Cardiomyopathies

EFFICACY OF EPICARDIAL DELIVERY OF CARDIAC STEM BASED CELL SHEETS AFTER MYOCARDIAL INFARCTION

Poster Contributions
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Background: Cell therapy is thought to be a promising therapeutic strategy for the treatment of heart failure. Although the type of cell transplanted influences the outcome of stem cell transplantation, the method of transplantation is also important, as the efficiency of engraftment after simple needle injection is poor. Scaffold-free cell sheet (CS) transplantation technology is one of the most promising methods in this regard. The aim of the present study is to investigate the regenerative potential of cardiac stem cells (CSC) based sheets.

Methods: For CS formation c-kit+Lin- rat cells were cultured on plates coated with synthetic temperature-responsive culture dishes covalently bonded to the temperature-responsive polymer poly-N-isopropylacrylamide. Detachment CS from culture dishes was performed by lowering the culture temperature which promoted a rapid surface transition from hydrophobic to hydrophilic and provided viable monolayer CS formation with full preservation of the cell-cell contacts and extracellular matrices.

Results: Immunofluorescence analysis of CS frozen sections showed that they are consist of a combination of extracellular matrix proteins and cells interacting with each other via connexin 43-containing gap junctions. Cultivation of CSC in the CS retained their ability to proliferate and upregulated the expression of the cardiac transcription factor Gata 4. Transplantation of CS after experimental myocardial infarction on the surface of infarct zone of the heart caused their integration into the damaged myocardium and significantly increased left ventricle wall thickness in the post-infarction scar zone two weeks after infarction. CSC cells retained the ability to proliferate and migrate into the neighboring myocardium. Part of cells in the CS differentiates to cardiomyocyte- and endothelial-like cells. Significant vascularization of CS was observed two weeks after transplantation.

Conclusion: Transplantation of CSC based CS to the infarct heart effectively stimulates regeneration of heart muscle and may be considered as an alternative to traditional methods of delivery of stem cells to the myocardium.